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Age, cohort and period effects in the prevalence of sleep disturbances among older people: The impact of economic downturn

Alex Dregan^{a,*}, David Armstrong^b

^a University of Surrey, Guildford, Surrey United kingdom

^b King's College London, London, United Kingdom

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ABSTRACT

Using two longitudinal and nationally representative datasets, this study employs a cross-cohort analysis to examine age, cohort and period effects in the prevalence of sleep loss through worry for people over the age of 50 in the UK. The likelihood of reporting sleep loss through worry is calculated at two time-points for 7785 respondents from the Health and Activity Survey (HALs) and 21,834 respondents from the English Longitudinal Study of Ageing (ELSA), with baseline information on sleep loss through worry. Descriptive statistical methods were applied to determine the prevalence rates in sleep loss through worry at each survey within both datasets. The results of analysis reveal that sleep loss through worry declined with age, but this pattern was tempered by a temporary increase in the early 1990s. The contemporary economic downturn is suggested as a possible explanation for the significant increase in the prevalence of sleep loss through worry in 1991.

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Introduction

There is substantive evidence that sleep loss is associated with impaired psychological functioning such as decreased cognitive performance (Horne, 1988), impaired driving (Verster, Veldhuijzen, & Volkerts, 2004) and poorer moral judgment (Killgore, Balkin, & Wesensten, 2006), but also with a range of negative health-related outcomes including impaired immune function (Benca & Quintans, 1997), elevated cortisol levels (Leprout, Copinschi, Buxton, & Van Cauter, 1997), lower quality of life (Verster, Pandi-Perumal, & Streiner, 2008), increased risk of depression (Novati et al., 2008) and alcohol problems (Crum, Storr, Chan, & Ford, 2004). Work problems have also been found to be associated with indicators of insomnia, including lost sleep over worry and disturbed nights items of the GHQ-30 (Shigemi, Mino, & Tsuda, 2000). Further, there are suggestions that sleep loss may be associated with significant physical diseases such as diabetes (Spiegel, Knutson, Leprout, Tasali, & Van Cauter, 2005) as well as its well-known association with anxiety and depression (Wehr, 1991).

Given the relationship between sleep disturbances and negative outcomes there is increased concern that reported difficulties with sleeping seem to be getting more common. A study from

Sweden, for example, reported a fivefold increase in the prevalence of sleep disturbance between the early 1980s and early 2000s (Hetta, Mallon, & Broman, 2006). Whereas in 1981 the response to a question on sleep disturbance (6 months with sleep disturbance) indicated that 9% had disturbed sleep by 2003 the prevalence rate increased to 45%. Such changes have also been found in longitudinal studies which ensure that observations at two time points are conducted on the same population. For example, a study conducted by Broman, Mallon, Smedje, Bengtson, and Hetta (2004) with 1962 individuals aged 20–59 from Sweden over a 10 year period found that the prevalence rates of poor sleep quality increased from 11.7% in 1993 to 20% in 2003. Like Hetta et al. (2006), Broman et al. (2004) concluded that there had been a considerable increase in both insufficient sleep and insomnia complaints during recent years.

The discovery of increasing sleep disturbances in cross-sectional surveys suggests a time or period effect in which the environment changes between the two measurement points. An increasing prevalence of sleep disturbances could, for example, reflect a noisier environment in recent years or a common exposure to increased financial or job insecurity during a period of economic downturn. The problem with inferring a time effect in cross-sectional surveys is that the population in different rounds can vary so that longitudinal or cohort designs are preferred in which there is a stable population for repeated measurements.

Longitudinal designs, however, suffer from the drawback that it is difficult to disentangle age effects. An observed increase in sleep

* Corresponding author. Department of Sociology, University of Surrey, Guildford, Surrey GU2 7XH, United Kingdom. Tel.: +44 (0) 1483 683966.
E-mail address: a.dregan@surrey.ac.uk (A. Dregan).

disturbances between, say, 1980 and 2000 may reflect a time effect such as a change in the environment during the latter part of that period, or it may simply reflect that the cohort is 20 years older. The latter explanation seems a very real possibility given the evidence that age (together with gender) seems to be the most important demographic variable associated with the increasing prevalence of sleep disturbance (Foley, Monjan, Simonsick, Wallace, & Blazer, 1999; Ganguli, Reynolds, & Gilby, 1996; Groeger, Zilstra, & Dijk, 2004; Jagus & Benbow, 1999; Kojima et al., 2000; Morgan, Healey, & Healey, 1988; Ohayon, 1996; Pallesen et al., 2001; Van Cauter, Leproult, & Plat, 2000). Over the last ten years, various studies have suggested that older people are at increased risk for disturbed sleep with adverse impacts on their health and well being (Chevalier et al., 1999; Dew et al., 2003; Groeger et al., 2004) – although other studies have claimed that when more strict criteria are used for sleep disturbance the association with age is less clear (Ford & Kamerow, 1989).

But just as changes in sleep disturbance prevalence in a population over time are confounded by ageing so ageing effects might be contaminated by period influences and cohort effects. It is possible that, say, 75 year old men have more sleep disturbance than 50 year old men in any particular year but that these differences would not have been observed a decade or so earlier in similar aged men. This may be due to a time effect – perhaps a period of social crisis – or the fact that these 75 year olds belong to a cohort which had its sleep patterns fixed much earlier in the century.

Cohort effects indicate the long-lasting impact of risk factors (e.g. poor sleep hygiene) or environmental exposure (e.g. poor diet) in early life or are typical for a given generation (Wolfe & Burney, 1992). Cohort effects are therefore associated with long-term sleeping habits or long-term exposures to different risk factors (such as poverty or greater competition for jobs among larger cohorts such as the baby-boom cohort Maxim, 1985). There is evidence, for example, of significant changes in the prevalence of a range of physical, social, and psychological disorders known to be associated with sleep disturbance amongst different birth cohorts (Cayuela, Rodríguez-Domínguez, López-Campos, Otero Candellera, & Rodrigues Matutes., 2004; Klerman, Lavori, & Price, 1985; Peltonen & Asplund, 1996; Wolfe & Burney, 1992). Yet cohort, period, and individual (age) effects are so intertwined that one of them is not controlled in any form of analysis (Fu, 2008; Susser, Schwartz, Morabia, & Bromet, 2006; Winship, 2008). This problem arises because an individual's age at the time of the observation is defined by the interval between the date of birth (cohort) and the date of observation (period). Consequently, the individual's risk of sleep loss through worry at a given age necessarily reflects cohort and period effects which need both longitudinal and cross-sectional studies to disentangle.

The aims of the present study were to explore the age, period and cohort effects in sleep loss through worry for people aged 50 and over between the mid 1980s and the present. Sleep loss through worry was chosen because not only is it the main reason for sleep loss (Spiegel et al., 2005) but it forms a standard question in the General Health Questionnaire (GHQ; Goldberg, 1972) which is frequently used in population studies. And given the reported greater prevalence of sleep disturbance in women (Berger, Luedemann, Trenkwalder, John, & Kessler, 2004; Breslau, Roth, Rosenthal, & Andreski, 1996; Hislop & Arber, 2006; Morgan et al., 1988; Singleton, Bumpstead, O'Brien, Lee, & Meltzer, 2003; Van Cauter et al., 2000) and the complex relationship between gender and age in the general population, the present study also examined these trends across gender. The study employed two large, longitudinal and nationally representative for England samples of adults age 50 and over.

Methodology

Two longitudinal surveys, Health and Activity Lifestyle Survey (HALs) 1984–1985 and English Longitudinal Study of Ageing (ELSA) were used in the study. These surveys used nationally representative samples so ensuring generalisability of any findings and asked an identical question about sleep (from the GHQ-30) both between and within the surveys. The two datasets were accessed from the ESDS website (Essex University).

The Health and Lifestyle Survey was designed to examine the distribution of, and the relationship between, physical and mental health, health-related behaviour (diet, exercise, smoking and alcohol consumption), social circumstances, and beliefs and attitudes, in a representative sample of the age 18 and over population of the UK. The survey comprised two waves, 1984/1985 (HALs1) representing the baseline and a 7 year follow-up in 1991/1992 (HALs2). HALs2 collected additional information about events happening in the intervening 7 years. The survey design has been detailed elsewhere (Cox, Huppert, & Whicheelow, 1993).

HALs1 was carried out on a stratified random cluster sample of 9003 adults living in the UK. Of the 9003 respondents interviewed at HALs1, 6626 were alive and approached 7 years later, and 5352 agreed to participate in the follow-up study. Compared to data from the 1981 national Census, the study population has a slight excess of women, and some differences from the Census population at the extremes of the age spectrum, with a slight under-representation of single persons. These are likely to be accounted for by differences in availability for interview but overall the sample was judged representative (Cox et al., 1987). An attempt has been made to estimate the possible bias in the attrition between surveys and allow for it in the analysis and interpretation of findings. This was achieved by using factors that predicted differences in baseline (1984/1985) between respondents who participated and those who were missing from the 1991/1992 survey as covariates in subsequent analyses. As the data were considered (Cox et al., 1993) to be representative of the adult UK population at the time of the data collection no weighting was performed.

The English Longitudinal Study of Ageing (ELSA) aimed to examine, over time, the relationships between health, economic position and activity, social participation, productivity, networks and support. The ELSA sample is representative of people aged 50 and over and their younger partners, living in private households in England. It was drawn from households that had previously responded to the 1998, 1999, and 2001 surveys of the Health Survey for England (HSE) and forms the basis for subsequent waves of the study. Three further follow-ups were conducted at 2002/2003, 2004/2005, and more recently 2006/2007. At wave 3 (2006/2007) a refreshment sample ($n = 1733$) of younger HSE sample members were added. This was done to replace the youngest people as they were no longer represented due to the ageing of the original sample. This new sample of respondents, aged 50–53 (and their older/younger partners), was drawn from responding households at HSE 2001, 2002, 2003 and 2004. A detailed description of the study is provided elsewhere (Marmot, Banks, Blundell, Lessof, & Nazroo, 2003; Nunn, Cox, Wood, & Scholes, 2008).

The baseline (1998/1999/2001) sample included 19,837 individuals who were also eligible to participate at wave 1 (2002/2003). Around 12,100 respondents continued to take part at wave 1 (the 2002/2003), 8780 at wave 2 (2004/2005), and 9771 at the latest wave (2006/2007). As information on sleep lost through worry was not collected at the second wave (2004/2005) only the baseline, wave 1, and wave 3 data were used in the present study. At each wave the data was collected via a face-to-face CAPI interview, a nurse visit, and a self-completion questionnaire. The wave 1 and 3 data have been weighted in order to reduce the bias from non-

response. The equal probability design of the HSE samples, and the fact that the ELSA sample included all eligible adults from the HSE, eliminates any need for weights to account for selection probabilities. No differences were found between the demographic characteristics of the ELSA respondents and the national population using Census data.

Measures

The outcome of interest in both datasets was the second question of the GHQ-30 which asked: 'have you lost sleep through worry?' The time-frame of the measure in both data-sets was over the past few weeks and stressed the present and recent rather than past sleep complaints. Using the standard method of scoring which assigns 0-0-1-1 to the four possible answers, this question was transformed into a dichotomous indicator of whether the participants responded negatively (1) or not (0). In other words, if the given response was 'not at all' or 'not more than usual' a score of 0 was recorded and 1 if the response was recorded as 'more than usual' or 'much more than usual'. [Hankins \(2008\)](#) found higher reliability estimates and the least measurement error of this scoring method compared to the Likert method (0-1-2-3) or C-GHQ method (positively phrased items coded 0-0-1-1; negatively phrased items coded 0-1-1-1). The standard method (0-0-1-1) is also most commonly used to detect current, nonspecific psychological distress in clinical and community-based samples ([Andersen, Sestoft, Lillebaek, Gabrielsen, & Hemmingsen, 2002](#); [Armstrong & Earnshaw, 2004](#); [Goodchild & Duncan-Jones, 1985](#); [Laaksonen et al., 2009](#)) and has been used to investigate the relationship between sleep loss through worry with alcohol problems ([Crum et al., 2004](#)).

To explore the change in the prevalence rates of sleep loss through worry over time across the different age groups, respondents' age was coded into five separate categories: 50–56, 57–63, 64–70, 71–77, and 78 and over as equal intervals between times of measurements are preferred when investigating time and age trends in prevalence rates ([Masche & Van Dulmen, 2004](#)). Given the interval of 6–8 years in the HALs study and 6–9 years in the ELSA study, it was decided that dividing the sample of the two datasets into sub-samples of 7 years ensured a better approximation of the assessment dates. To some extent, this interval fits possible changes in the dependent variable and also allows comparison between the two surveys. Although the ELSA study would have allowed splitting of the sample into 3-years groups (which might have offered a better fit with the changes in the dependent variable) this was not possible for the HALs sample. Nevertheless, the 2002/2003 ELSA wave data was included in the analysis as it provided the opportunity to observe possible variations in time trends in the prevalence of sleep loss through worry. Because of the splitting into 7 years groups and the fact that the surveys spread over two years, there is the possibility of slight misalignment but given that the same applies to each age group this should not impact on the overall age trends.

Predictor variables

A range of other factors were used as covariates (mainly dichotomous) in regression analyses and included gender (male/female), ethnicity (white/other), socio-economic status (low social class/high social class), smoker (yes/no), alcohol problems (yes/no), education (no qualifications/has qualifications), accommodation type (council accommodation/owned or private), health status (health problems/no health problems), household income (less than or equal to £230 a month/more than £230 a month), retirement (good/bad effect on health), major financial problems over

the last year (yes/no), mental disorders (yes/no), job loss (yes/no), marital status (single/couple or married), and family death or illness (yes/no). Respondents were also coded for their region of residence into 9 categories: Greater London (reference category), North, North West, Yorkshire and Humberside, West Midlands, East Midlands, East Anglia, South West, and South East.

Statistical analysis

The HALs data was restricted to England in order to match the ELSA study population. Only respondents aged 50 and over in both datasets were examined. As such, the analyses were based on 7578 respondents in 1984, 4481 respondents in 1991, 19,837 respondents in 1998, 11,392 respondents in 2002 and 9765 respondents in 2006. The distribution of the population in the HALs study was considered to compare reasonably well with that of the 1981 (HALs1) and 1991 Census data (HALs2) ([Cox et al., 1993](#)). ELSA study samples were also considered to be representative of the demographics of the England population. The major reason for non-response in the HALs study was death, particularly among the older age groups. For instance, 55% of the over 80s and 38% of the 70–79s in 1984 were dead by the 1991 follow-up. The death rate was lower in the ELSA study.

Preliminary analyses were carried out to explore the possible impact of non-response within the surveys. In the HALs study, non-respondents were more likely to be males, smoking, older, single, have poorer self-reported health, to be of non-white origin, but less likely to have had alcohol problems. With respect to the ELSA study the analyses showed that non-respondents were more likely to be those selected from the 1998 and 1999 HSE surveys, to have lived in London, be from a non-white ethnicity, to have a poorer self-assessed health, lower educational qualifications and to have lived in urban areas. Older women were also more likely not to be participating in the last wave (2006/2007). Those variables that predicted differences were then included as covariates in the analyses in order to control for the variance in outcomes associated with these factors.

The ELSA study offered the possibility of comparing the differences in prevalence rates with and without weighted data for the probability of non-response. As the two sets of results were similar, it was decided that unweighted data provides an unbiased estimation of the prevalence rates in sleep loss through worry over time and it was used in the main analyses. In addition, sensitivity analyses were conducted which compared the prevalence rates based on reported data with the results of the analysis under missing at random (MAR) assumption. As the analyses produced similar results, it was concluded that the MAR mechanism was plausible and that the missing observations are unlikely to alter the conclusions ([Kenward & Carpenter, 2007](#)).

Descriptive statistical methods were applied to determine the prevalence rates in sleep loss through worry at each survey within both datasets. Overall prevalence rates were calculated for each age group and sex at each wave of the two surveys. These rates were then plotted to provide a graph of the time and age trends in sleep loss through worry within each age group and across the two surveys. Multivariate regression analyses were then employed to explore predictors of sleep loss through worry. The analysis was carried out using SPSS vers.15.

Results

[Fig. 1](#) shows the effect of age on sleep loss through worry across the different cohorts. The overall pattern was for a decline in reported problems with age except for respondents in their 70s who experienced an increase in sleep problems in 1984 and 1991.

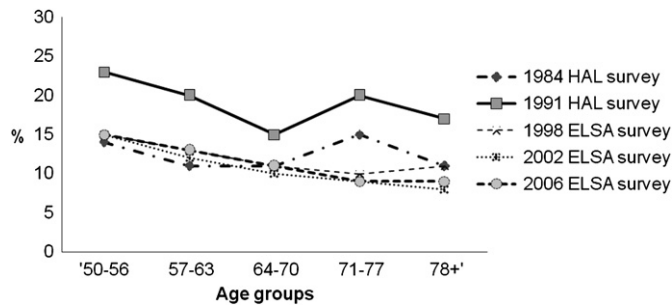


Fig. 1. Age trends in the prevalence rates of sleep loss through worry (%). These trendlines show the percentage of respondents with sleep loss through worry by age groups across each survey of the HALs and ELSA datasets.

Fig. 2 combines age, period and cohort effects and shows a marked increase in sleep loss through worry in the early 1990s across all cohorts followed by a decline over the subsequent decade. Figs. 3 and 4 show the same data by gender: both show a similar pattern of increasing sleep loss through worry in the early 1990s followed by a decline. The 1990s' rise, however, was more muted amongst males in the age group who were likely to be recently retired and did not occur for those in their 70s. Highest rises were found for males in their early 50s and for females across the range of age cohorts.

To establish whether the increase in sleep loss through worry in the early 1990s was a generalised phenomenon or a more marked impairment for a few, the distributions of severity were plotted for 1984 and 1991 (Figs. 5 and 6). These figures show that most of the rise was in the milder range of sleep loss through worry (i.e. an increase in 'less than usual').

To explore further the reason for the rise in sleep loss through worry in the early 1990s a backward stepwise logistic regression analysis was carried out to determine major predictors in both 1984/1985 (Table 1) and 1991/1992 (Table 2) surveys. Standardised coefficients showed that the main predictors in 1991/1992 survey were health problems followed by financial concerns. Health problems were also the main predictor of sleep loss through worry in 1984/1985 but financial problems did not appear to be associated with sleep loss through worry after adjusting for other covariates.

Discussion

This study explored the age, period and cohort trends in the prevalence of sleep loss through worry across different decades for males and females over the age of 50. The study has the advantage of using two large nationally, representative studies (with over 30,000 people from different areas of England) which allowed the

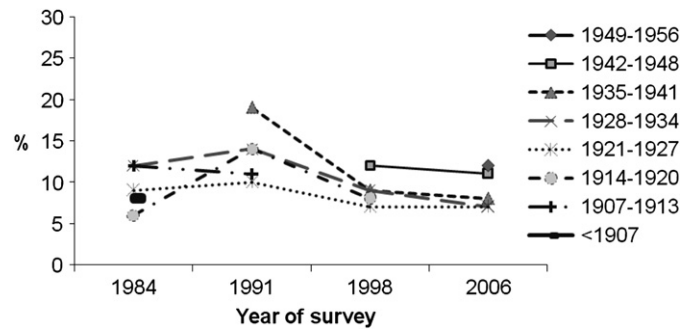


Fig. 3. Cohort trends in the prevalence rates of sleep loss through worry among males (%). These trendlines illustrate the change in the proportion of male respondents with a sleep loss through worry report across the HALs and ELSA surveys.

combination of cross-sectional and longitudinal designs in disentangling age, period, and cohort effects on sleep loss through worry.

Data were collected from the two cohorts at five different time points and using an identical single item sleep measure. Single item measures of sleep have been used in other studies and have been found to correlate well with other measures of sleep and to be good predictors of psychological distress (Kutner, Bliwise, Brogan, & Zhang, 2001; Manocchia, Keller, & Ware, 2001; Pien, Sammel, Freeman, Lin, & DeBlasis, 2008). Byles, Mishra, Harris, and Nair (2003) used a similar item 'worry keeping you awake at night' and found a prevalence rate of sleep loss of about 11% among women aged 73–78, which is similar to the findings reported here for the 71–77 women. The authors also found the item to be predictive of health-related quality of life using the SF-36. A disadvantage of this single item measure of sleep disturbance, however, is that it captures only one aspect of sleep disturbance and does not describe sleep loss through worry in detail (e.g. difficulty in falling asleep, difficulty maintaining sleep, early waking). Yet very few datasets (longitudinal and population based studies) include multiple items on this important aspect of health and disease (Doyle, Hanks, Cherny, & Calman, 2005). So while further details of sleep – such as patterns and chronicity of sleep disturbance as it relates to worry (Crum et al., 2004) – might be desirable the single measure used in this study has the virtue of simplicity and completeness across two large datasets.

This study found both an age and a period effect. Overall, between their 50s and late 70s the prevalence of sleep loss through worry for these respondents declined significantly. The finding that sleep disturbances decline with age has some support in the literature (Hoeymans, Feskens, Geertudis, & Kromhout, 1997; Idler, 1993; Linn & Linn, 1980) but the broader consensus, as described earlier, is that sleep disturbances increase with age. How can this

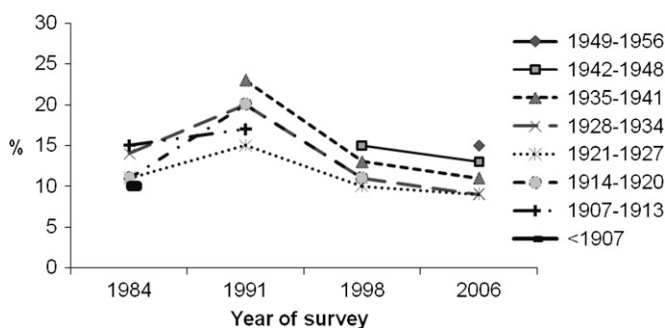


Fig. 2. Cohort trends in the prevalence rates of sleep loss through worry (%). These trendlines illustrate the change in the proportion of respondents with a sleep loss through worry report across the HALs and ELSA surveys.

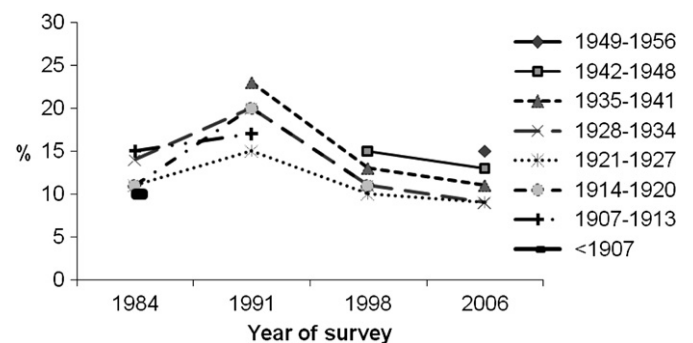


Fig. 4. Cohort trends in the prevalence rates of sleep loss through worry among females (%). These trendlines illustrate the change in the proportion of female respondents with a sleep loss through worry report across the HALs and ELSA surveys.

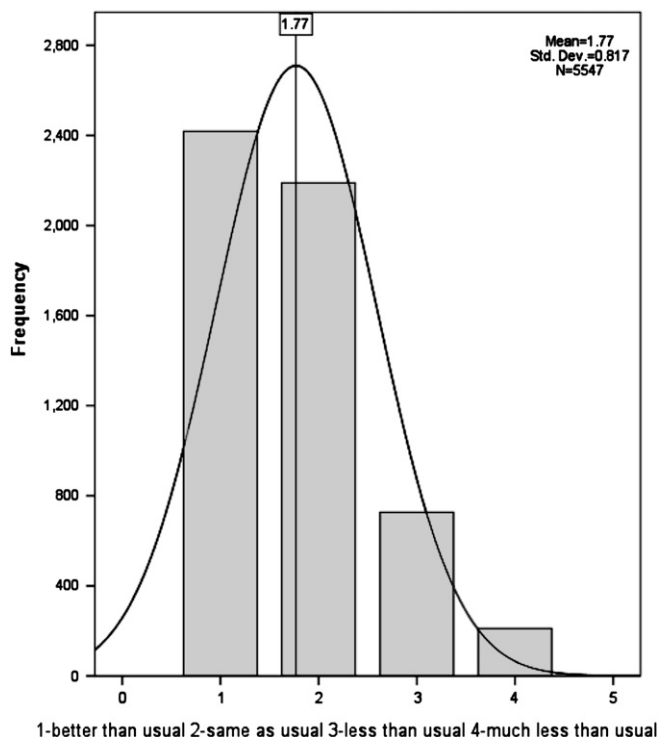


Fig. 5. Histogram of sleep loss over worry at 1984.

discrepancy be explained? First, it is possible that conflicting results might be accounted for by the particular sleep measure used. This study used 'have you lost sleep over worry?' as found in the cohort data studied but other measures may have revealed different patterns. The finding of an important period effect – a rise in reported sleep problems in the early 1900s – however, suggests another explanation, namely that age per se is not a significant risk

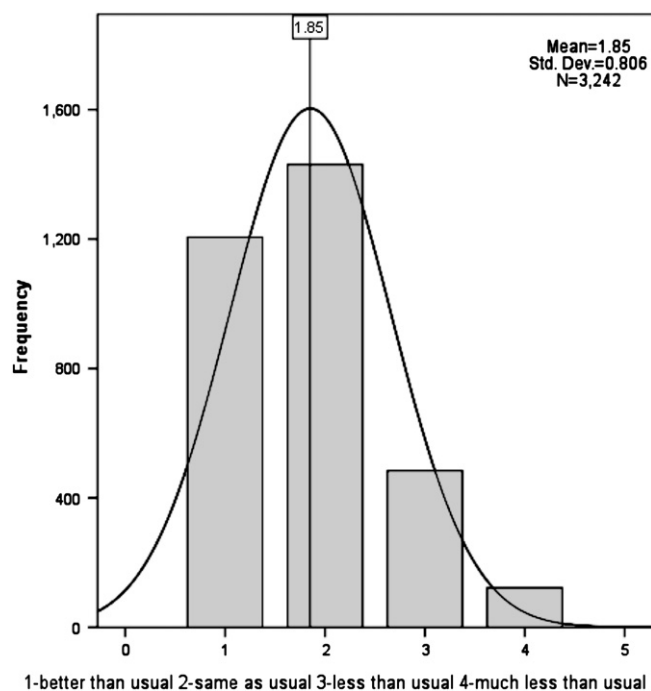


Fig. 6. Histogram of sleep loss over worry at 1991.

Table 1

Logistic regression analyses on the predictors of sleep problems over worry in the 1991 survey.

	OR	95% CI
Health problems	1.67***	1.24–2.24
Retirement	.43***	.26–.73
Financial problems	1.43*	1.05–1.96
Males (vs. females)	.54***	.42–.70
Age	.90*	.82–.99

Note: OR stands for odds ratio; CI stands for confidence intervals; * $p < .05$, ** $p < .01$, *** $p < .001$.

The table includes only those factors that were retained in the last regression model as significant predictors of sleep problems over worry. Variables entered in the analysis: health problems, families or friends health problems, death of family member, job change, job loss, major work crisis, partner loss of job or problems, retirement, house movement, accommodation, financial problems, gender, age, education, ethnicity, smoking, alcohol, socio-economic status, and mental health problems.

factor for sleep loss through worry; rather, that different studies conducted at different times and in different places are likely to find different age patterning because other socio-cultural and temporal factors are the prime determinants of sleep disturbance. As shown in this study, older age groups can have higher or lower rates of sleep loss through worry depending on contextual events.

A similar argument was advanced by Foley et al. (1999) which noted that the incidence of insomnia was not caused by the ageing process per se but rather by the presence of various individual risk factors. Likewise, Ohayon, Carskadon, Guilleminault, and Vitiello (2004) reported that age-related changes in sleep disturbance were moderated by medical and psychiatric morbidity, and that normal ageing processes were less important. Hall et al. (2008) found that financial strain was a significant predictor of sleep continuity even after adjusting for known sleep-related factors such as mental and physical health. The present study confirms Hall et al.'s (2008) findings and extends them across different age groups and time period. The greater prevalence of sleep disturbances among women compared to men also confirms prior findings (Berger et al., 2004; Morgan et al., 1988).

The main contextual event identified here is the rise in reporting of sleep loss through worry in the 1990s. This rise occurred in all cohorts suggesting something that happened uniquely at this time that was neither a consequence of belonging to a particularly susceptible cohort nor of reaching a certain 'at risk' age. The most likely explanation is the economic downturn in the UK in the early 1990s. The plausibility of an economic effect on sleep is supported by the regression analysis which identified financial difficulties as a major predictor of sleep disturbance for the 1991/1992 survey but not for the 1984/1985 survey.

The age patterning of sleep loss through worry amongst men also lends support to the impact of the economic downturn. The

Table 2

Logistic regression analyses on the predictors of sleep problems over worry in the 1984 survey.

	OR	95% CI
Health problems	2.11***	1.54–2.88
Disability	1.52**	1.12–2.07
Males (vs. females)	.50***	.36–.70
Council accommodation	1.41*	1.01–1.97
Region	.94*	.89–.99

Note: OR stands for odds ratio; CI stands for confidence intervals; * $p < .05$, ** $p < .01$, *** $p < .001$.

The table includes only those factors that were retained in the last regression model as significant predictors of sleep problems over worry. Variables entered in the analysis: health problems, work status, house movement, accommodation, financial problems, gender, age, education, ethnicity, smoking, alcohol, socio-economic status, and mental health problems.

latter might be least likely to affect men coming up to or recently retired as lack of workforce participation must obviate many of the threats of economic recession to job security. Equally the groups most affected by events in the 1990s were those around 50 and early 60 who presumably were more settled in a career that could be under threat. This general level of threat perhaps explains the fact that most of the increase in sleep loss through worry was at the milder end of the disturbance spectrum. The finding of higher reports of major financial problems over the previous year in people of working age (50 to 63) relative to the older age group supports this argument.

There are numerous reports which show that periods of weak or negative economic growth, particularly as manifest in high unemployment rates, are accompanied by worsening population health (Hall et al., 2008; Jin, Shah, & Svoboda, 1995; Linton, 2004). The exact relationship between an economic downturn – presumably operating through job loss and insecurity – is complicated by the way in which results seem to depend on the time lag incorporated in any model, that is because it is unclear how long after an economic crisis its health effects may manifest themselves (Brenner, 2005; Jin, Shah, & Svoboda, 1997). Unlike many illnesses, however, which may take years to develop, sleep loss through worry is likely to be a fairly immediate response to financial worries – and such sleep loss may in itself be contributory to (as well as being caused by) other illnesses. The strong association of health problems with sleep loss through worries found in this study attests to the importance of that relationship.

In summary, the fact that there are inconsistent reports of the effects of age on sleep may in part indicate the use of different measures of sleep disturbance, as described above, but it also may reflect on the way that age as a risk factor is mediated by many other factors. Based on Schaie's (1965; 1986) general developmental model the present study combined cross-sectional and time-sequential strategies followed by regression analysis to explore possible, age, cohort, and time effects in the prevalence of sleep loss through worry. The combination of different research designs and graphic display of sleep loss rates assisted with separation of historical trends in sleep loss through worry. The result is a better understanding of the separate effects of time, cohort and individual factors on sleep loss which suggests that the search for the underlying sleep patterns in a population is likely to be misguided: sleep is both socially and temporally located and is likely to vary between countries at any point in time depending on its historical and local determinants. Further, the role of sleep in mediating ill-health deserves more study given the relationship between sleep loss and the state of the economy.

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